Graduate School of Decision Sciences

Universität Konstanz

GSDS Working Paper No. 2018-03

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März 2018

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ISSN: 2365-4120
March 2018

Job Displacement and Training Activities: Human Capital Accumulation during the East German Transition

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Abstract

With the East German transition from a command to a market economy in the early 1990s, many East Germans lost their jobs because of firm closures while their human capital was not yet aligned to a modern market economy. I study how displaced East German workers reacted to that double effect of human capital depreciation. Using a difference-in-difference-in-difference set-up, I compare the effect of displacement on adult education between East and West German workers. In line with human capital theory, I find that East Germans increase their time investment in adult training significantly when they were displaced one or two years earlier. This increase in adult training is lower for older workers and not observable for West Germans. Moreover, the results suggest that when East Germans lose their job due to a plant closure, they prepone training activities to the time when they are not employed. In that sense, firm closures may have useful side-effects in a transition period as they allow people to work earlier against the human capital depreciation associated with the transition.

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I would like to thank, in particular, Guido Schwerdt but also all other participants of the Public Economics Seminar at the University of Konstanz for helpful comments.

1. Introduction

The most important investments in human capital are education and training (see Becker, 1993, p.17). Both education and training can either be specific or general. As the opposite of general training and education, specific training and education provide knowledge which are specific to a firm, industry, occupation, country, or political system. As outlined by Schmid-Schönbein (1997, p.57), in the former German Democratic Republic (GDR, in the following also called East Germany), many components of human capital were completely system-specific (juridical knowledge etc.). All other (learnable) components – as well as technical components – were also to some extent system-dependent. The technology in the GDR was outdated. When the Berlin Wall fell in November 1989, the existing human capital was not fully suitable for the modern technology which was implemented in the process of transition. Consequently, the East German's transition was necessarily combined with huge human capital depreciation - a depreciation in both specific and general human capital.

In this paper, I study how people reacted to this human capital depreciation and compare their time investment in training activities to the investment of peers who lived in the rather stable market economy of West Germany. Thereby, I test the theory on the time-profile of investment in human capital in a non-standard setting - in a transition from a command to a market economy.

The theory on the time-profile of human capital investment has been developed by Mincer (1958, 1962), Becker (1962, 1964) and Ben-Porath (1967). Here, three claims from the seminal book by Becker (1964) are of main interest. First, with a constant rate of return, "a considerable incentive would exist for everyone to invest immediately rather than waiting. (...) [Second,] the number investing would tend to decline rapidly with age even if the rate of return did not (Becker, 1964, p.50)." [Third,] "younger people have greater incentive to invest because they can collect the return over more years" (Becker, 1964, p.50). Following these predictions, East Germans are expected to invest in their human capital as soon as possible and younger people are expected to invest more on average. Assuming that the human capital of West Germans was not affected by the reunification, all else equal, West Germans are expected to invest less in training. Even when they lose a job, they are expected to invest less in training because they only lose firm-specific human capital; general human capital investments have not depreciated. West Germans could nevertheless undergo training in order to increase their labor

market options, but their incentives would be smaller than for East Germans.

This study focuses on people who experienced a job loss due to a plant closure within the very first years of the East German transition process. A plant closure is an exogenous shock that affects everyone within the plant independent of personal characteristics or skills. I argue that the characteristics of displaced workers and (matched) non-displaced workers only differ randomly and, therefore, use the non-displaced workers as the counterfactuals of the displaced workers.

By investigating the effect of job displacement on training activities, this study provides new insights on the process of human capital accumulation during economic transitions. Moreover, contrary to the existing literature, I analyze the impact of different economic environments; this is done by comparing the displacement effect on training activities between East and West German workers in the first years after the German reunification.

The aim of this paper is to answers the following questions: Does job displacement increase adult training activities? Is this rise in training activities stronger for people from the transitioning East German economy than for West Germans? And, after displacement, do young East Germans invest more time in training than older East Germans?

In order to answer these questions, an exact matching technique is used to compare the treatment group of displaced workers with a control group of non-displaced workers. Within the matched sample, I make use of a difference-in-difference model introduced by Jacobson, LaLonde & Sullivan (1993), the common approach to study the treatment effect of a plant closure (see e.g. Stevens, 1997, Couch, 2001, Schmieder, Wachter & Bender, 2010, Ichino, Schwerdt, Winter-Ebmer & Zweimüller, 2017). I then extend the model by another difference-in-difference set-up to compare the displacement effects between East and West Germans (and between young and old East Germans). In order to rule out limitations of the natural East-West-German experiment, I conduct several robustness checks and discuss, among others, how East-West migration might affect the results.

In line with the theory on the timing of human capital investments, I find that East Germans increase their time investment in adult training significantly when they were displaced one or two years earlier; this increase in adult training is lower for older workers and not observable for West Germans. Moreover, the results suggest that, when East Germans lose their job due to a plant closure, they increase their training activities as soon as they are not employed anymore and, thereby, counteract the human capital depreciation associated with the transition earlier.

The paper proceeds as follows: In the next section, I present a brief literature review and the paper's contribution to the existing literature. In Section 3, I introduce the data, the main variables of interest, and the matching procedure. The estimation approach is presented in Section 4. The results are shown in Section 5. In Section 6, I discuss limitations and how they might influence the results. The paper closes with a summary and conclusion.

2. Related Literature

This paper contributes to several branches of the literature: the literature on outcomes of job displacements, the literature on the transition of socialist command economies, and the literature on adult training. A wide range of outcomes of job displacement have already been studied; among them, labor market outcomes like unemployment spells, earnings losses, and sectoral mobility (see, e.g., Ruhm, 1991, Jacobson et al., 1993, Stevens, 1997, Couch, 2001, Bender, Dustmann, Margolis & Meghir, 2002, Kletzer & Fairlie, 2003, Schmieder et al., 2010), outcomes on regional mobility (see, e.g., Bailey & Turok, 2010, Fackler & Hank, 2016), health (see, e.g., Gallo, Bradley, Falba, Dubin, Cramer, Bogardus & Kasl, 2004, Browning, Moller Dano & Heinesen, 2006, Browning & Heinesen, 2012, Sullivan & Wachter, 2009) and family life (see, e.g., Charles & Stephens, 2004, Del Bono, Weber & Winter-Ebmer, 2012).[1] Despite the extensive research on displacement outcomes, almost nothing is known about the effect of job displacement on adult education or training. To my knowledge, only one study on post-displacement human capital investments exists: Chapman, Crossley & Kim (2003) investigate displaced workers' credit constraints for human capital investments using Canadian data. The present paper attempts to close this gap.

The displacement literature focuses mainly on industrialized countries and market economies. Some studies consider the effect of displacement in a rather stable economic period (e.g., Couch, 2001, Burda & Mertens, 2001, Bender et al., 2002, Kletzer & Fairlie, 2003, Gallo et al., 2004) while others investigate a specific recession period (Appelqvist, 2007, Schmieder et al., 2010, Farber, 2011). However, less is known about how the displacement effect depends on the economic environment. Only a few studies compare displacement outcomes across different economies. One exception is the book *Losing Work, Moving On* edited by Kuhn (2002). It provides standardized results and compares them across several industrialized Western countries and Japan.

[1] For a recent literature review, see Baumann (2016, Chapter 1). Earlier reviews on the extensive research on displacement costs in the U.S. have been provided by Hamermesh (1989), Fallick (1996).

Displacement effects in transitioning East European economies are even less considered. By focusing my analysis on Germany in the early 1990s, I am able to compare the effect sizes of job displacement between the rather stable West German market economy and the transitioning East German economy. As described in previous studies (Fuchs-Schündeln & Schundeln, 2005, Alesina & Fuchs-Schündeln, 2007, Fuchs-Schündeln, 2008, Rainer & Siedler, 2009), the advantage of focusing on Germany is that, in 1989, the Berlin Wall fell unexpectedly; and moreover, with the reunification, both parts of Germany fell under the same legal and institutional setting while their economic backgrounds still differed. This environment provides a unique opportunity to investigate the historical impact on socio-economic outcomes.

For the Eastern part of reunified Germany, there is now a substantial body of research on retraining and continuing education that took place in the 1990s. The focus of this research lies on the effects of retraining and continuing education on labor market outcomes. Their findings have no clear evidence for a positive employment effect of training in the short run (see Speckesser (2004, Chapter 1) for an extensive review); however, in the medium and long run, several training programs were found to improve the participants' labor market outcomes (Lechner, Miquel & Wunsch, 2007, Fitzenberger & Völter, 2007, Fitzenberger & Speckesser, 2007).[2] To study the treatment effect of training activities, these studies have a control group representing the counterfactual. As training outcomes are considered in these studies, the individuals' ability should not differ between treated individuals and counterfactuals. However, this might not be the case since observable characteristics like formal education, occupational positions, and tenure provided no clear evidence of ability, but were also consequences of political conformity and dis-conformity. Hence, all studies on training effects in East Germany may strongly suffer from endogeneity due to an unobserved ability bias. In the present study, this bias is reduced by focusing on the effects of a plant closure which occurred independently of individual characteristics. Furthermore, I exploit a matching approach to compare displaced workers only with matched non-displaced workers with the same characteristics.

In this paper, I investigate how job displacement affects training activities of East Germans and West Germans in the early 1990s. Workers displaced in the early 1990s had no reason to doubt that further training improves future labor market outcomes. Although training programs have already been developed for unemployed workers in West Germany before the reunification, a lack of data and a lack of an appropriate methodology made it impossible for researchers to

[2] See Wunsch (2005, Table A.3) for a summary of earlier findings.

study how further training affects future employment and earnings before the 1990s (Wunsch, 2005, Section 6.5). Contrary to research on the effect of training on labor market outcomes, research on the opposing effect, i.e. the effect of labor market outcomes on training, has been studied little. By focusing on the effect going in the less prominent direction, the paper provides new insights on human capital accumulation.

3. Data

The German Socio–Economic Panel (GSOEP) is a yearly, longitudinal survey, conducted on a yearly basis since 1984. East Germans were surveyed for the first time in 1990. In this study, the distinction between East and West Germans are based on whether they lived in the East or in the West prior to 1990.[3] In 1990, the GSOEP covers a total of about 14,000 successfully-interviewed individuals, of which 95% are still surveyed in 1998. To ensure that attrition is not driving the results, I keep only those individuals who have been surveyed from 1990 until 1998.[4,5]

Moreover, I restrict the sample to people who were at working age prior to the transition. All individuals who were younger than 25 in 1990 are excluded to ensure that the East Germans finished their education under the socialist regime and before the transition process started. People are excluded as soon as they become older than 55 because, then, they may retire early. Those who turn 55 before the year of the plant closure are also dropped from the sample.[6]

The study focuses on plant closures between 1990 and 1994. In each of these years, among the remaining individuals, between 1.5% and 6% of the East Germans and less than 1.5% of the West Germans lost their job because of a plant closure (see Figure 1).

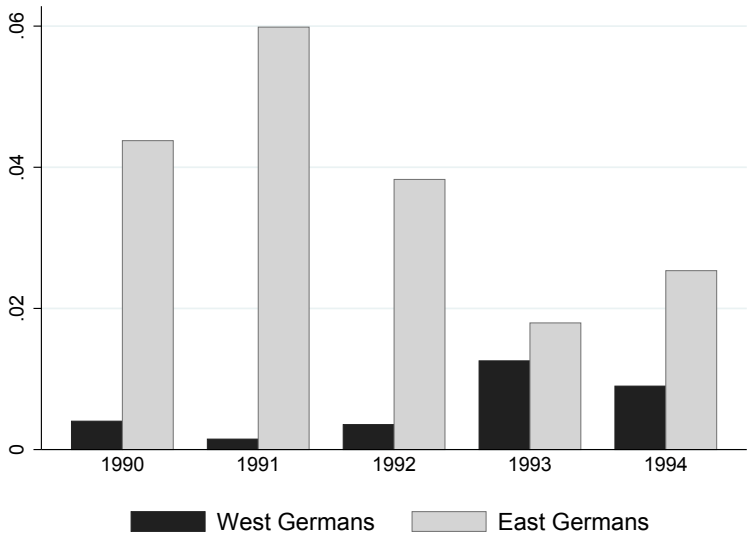
[3]The GSOEP covers a question about the *place of living in 1989*. Berlin is divided into East Berlin and West Berlin. I adjust implausible answers: People who responded to the GSOEP before 1990 are re-coded as West Germans and people who were living in East Germany in 1990, were not interviewed before 1990, and received their education from the GDR are re-coded as East Germans. I also repeat the analysis excluding the individuals with implausible declarations of their place of living. The results do not change.

[4]Employment and training spells are always collected with one year of delay. Therefore, the data on 1998 is required for the training and employment spells in 1997.

[5]Some gaps exist in the spell data. These gaps are coded as missings. I also conduct the analysis by completely excluding individuals with such missing values at any month and another analysis without excluding any individuals with gaps or incomplete information. In both cases, the effects are less significant but the effect patterns do not change.

[6]In a robustness test, all people are dropped from the sample completely when they turn older than 55 before the last year of interest, i.e. in the third year after the plant closure. The main results remain unchanged.

Figure 1: Share of Displaced People Aged 25 to 55



Notes: GSOEP, own calculations, weighted according to the cross-sectional weights.

3.1. Variables

For the analysis, information on human capital investments, employment, and job displacement are needed. The following subsections explain in detail how these are obtained.

Training and Employment

One advantage of the GSOEP is that it provides information on training and employment spells for East Germans since January 1990. The respondents are asked for each month of the previous year, among others, whether they have been in vocational training, whether they have been full-time employed, whether they have been part-time employed, whether they have been working short hours, and whether they have been unemployed. Using this information, I construct a variable on the number of months in which the respondent has undergone some vocational training. Hence, this training variable takes the values $0, 1, \ldots, 12$. Although the intensity of this human capital investment is not observed, it is straightforward to assume that the more months someone does training, the more time is invested in human capital accumulation.[7]
The employment variable is constructed using the same information as the training variable. An individual is coded as employed for that year, if she states that she has been employed

[7]To additionally test the robustness of the training variable, I re-code training in two different ways. First, I evaluate the number of months with vocational training on a quarterly basis. Second, I evaluate for each quarter the extensive margin of vocational training, i.e. I take a dummy for *whether* the respondent was in vocational training in the specific quarter. Then, the estimated effects are less significant, but point in the same direction.

part-time or full-time in more than 6 months of the year.[8]

Job Displacement

In 1991, the GSOEP started asking the survey respondents whether they have lost their *last* job in the current or in the last calendar year, in which month the job loss occurred, and how they lost their job. One of the options for the job loss is *a plant closure*.[9] People who check the box for this option are coded as being displaced if the displacement occurred between January 1990 and December 1994. All other people - employed, unemployed, in the labor force, or out of the labor force - are coded as not being displaced, and are potential members of the control group.

3.2. Matching

In the East German subsample, I identify 236 workers who experienced a job loss due to a plant closure between 1990 and 1994; in the West German subsample, 97 displaced workers are identified. These displaced workers might not represent a random sample of the (GSOEP) population; the GSOEP population also covers housewives and long-term unemployed, and plant closures may be more prevalent among firms which do not promote training activities of their employees.

Therefore, I restrict the potential control group of non-displaced people by applying an exact matching technique for each displacement year within the East and West German subsamples. Potential control group members are kept if, first, they are at most 55 years old in the year of the plant closure and, second, if they match with a displaced worker in all of the following criteria in the pre-displacement calendar year: sex, age group (old: older than 40 in 1990, young: 40 at most in 1990), formal education (3 categories: low - no job qualification degree, middle, high - job qualification degree from university or similar institution), number of months with training, unemployment, and employment.[10] Applying this matching procedure, 13 displaced workers remain unmatched and, therefore, are excluded from the sample. In the end, the East (West) German subsample covers 228 (92) displaced workers in the treatment group which are

[8] As this cutoff of 6 months is chosen arbitrarily, I also re-run the analysis with the cutoff at 5 and 7 months but results do not change. The specification of this variable is also tested by considering, first, the employment from the last December and, second, full-time employment in more than 6 months of the current year. Again, the results are robust to these changes.

[9] The original answer in the German survey is "Wegen Betriebsstillegung / Auflösung der Dienststelle".

[10] For East Germans in 1990, some criteria are unknown. To not lose these observations, a displaced worker with an unknown characteristic is matched with controls who have the same unknown characteristic.

matched with 4,014 (8,497) controls.

For the analysis, both displaced workers and workers in the control group are weighted. The displaced workers are weighted according to the longitudinal weights provided by the GSOEP. Considering, for each year t, the number of displaced workers and controls which coincide in their matching criteria in the year prior to the plant closure, the new longitudinal weights of the controls are set as follows:

$$new\ weight_{i,t} = old\ weight_{i,t}\ \frac{\sum_{j\in\ Displaced} old\ weight_{j,t}}{\sum_{j\in\ Controls} old\ weight_{j,t}}.$$

Thereby, the weights of the controls are adjusted twofold: by the weighted number of displaced workers matched and, reciprocally, by the weighted number of controls matching the same displaced workers.

Treatment versus Control Group

For each regional subsample, Table 1 summarizes observable characteristics of the treatment and control group prior to the plant closure. Differences between displaced and non-displaced workers are negligible regarding the exact-matched variables: sex, education in 1990, months in training, etc. It is reassuring that other variables like age, tenure, and employment, which were not among the matching variables, are also almost perfectly matched in the last interview prior to the plant closure; mean values of age and tenure and the size of the employment categories differ barely between the control and treatment group. It is also reassuring that, prior to the plant closure, education levels of the control and the treatment group differ only marginally, although the matching took place on formal education in 1990, i.e. on education which had mostly been received prior to reunification. Control and treatment group only vary slightly in terms of plant size. Displaced workers had worked in middle size firms more often than workers in the control group. For the West German subsample, this discrepancy diminishes.

Table 1: Sample Characteristics

	East Germans		West Germans	
	Displaced	Non-displ.	Displaced	Non-displ.
General sample characteristics				
Female	0.60	0.60	0.38	0.38
Age, plant closure year	42.28	42.45	42.62	41.90
Older than 40, 1990	0.53	0.53	0.47	0.47
Education, 1990				
low	0.05	0.05	0.22	0.22
middle	0.69	0.69	0.69	0.69
high	0.26	0.26	0.07	0.07
unknown	0.00	0.00	0.01	0.01
Sample characteristics: year before the plant closure†				
Months in training	0.11	0.11	0.02	0.02
Months unemployed	0.02	0.02	0.00	0.00
Months employed	11.83	11.83	11.88	11.88
Sample characteristics: last interview before the plant closure^{+}				
Education				
low	0.05	0.05	0.22	0.23
middle	0.70	0.69	0.70	0.69
high	0.25	0.26	0.08	0.07
unknown	0.00	0.00	0.00	0.01
Employment				
full-time	0.85	0.86	0.86	0.80
part-time	0.12	0.12	0.10	0.16
marginal	0.00	0.00	0.01	0.03
none	0.02	0.02	0.02	0.02
Firm size				
1-19	0.14	0.15	0.21	0.20
20-199	0.38	0.33	0.28	0.24
200-1999	0.33	0.27	0.24	0.24
$\geq$2000	0.13	0.21	0.23	0.27
non-applicable	0.02	0.02	0.02	0.02
unknown	0.00	0.01	0.01	0.01

Continued on next page ...

Notes: †Not available for East Germans in 1989.
$^{+}$For the control group of non-displaced workers, the numbers refer to the interview in the treatment year if the interview month lies before the median displacement month; otherwise, the answers of the previous survey year are evaluated. For 12 West Germans controls of the 1990 plant closures, a 1989 survey is not available and 10 East Germans who were displaced in 1990 were not interviewed before the displacement.
GSOEP, own calculations using cross-sectional weights adjusted by the number of treated workers and matched controls.

... Table 1 continued

	East Germans		West Germans	
	Displaced	Non-displ.	Displaced	Non-displ.
Tenure				
mean	13.15	13.66	11.79	13.02
unknown	0.02	0.02	0.04	0.03
Observations				
Plant closure 1990	61	992	11	1814
Plant closure 1991	74	924	7	1184
Plant closure 1992	47	789	15	1575
Plant closure 1993	18	697	36	1984
Plant closure 1994	28	612	23	1940
N, total	228	4014	92	8497

Notes: †Not available for East Germans in 1989.
+For the control group of non-displaced workers, the numbers refer to the interview in the treatment year if the interview month lies before the median displacement month; otherwise, the answers of the previous survey year are evaluated. For 12 West Germans controls of the 1990 plant closures, a 1989 survey is not available and 10 East Germans who were displaced in 1990 were not interviewed before the displacement.
GSOEP, own calculations using cross-sectional weights adjusted by the number of treated workers and matched controls.

4. Methods and Assumptions

4.1. Baseline Model

The baseline estimation is applied to the East and West German subsample separately as well as to a subsample of young East Germans and a subsample of old East Germans. I use the following model by Ichino et al. (2017), which combines plant closures of several years by adjusting the approach of Jacobson et al. (1993):[11]

$$Y_{it} = \theta_t + \sum_{k=-2}^{3} PC_{it}(k)\ \psi^k + \sum_{k=-3}^{3} (DP_i \times PC_{it}(k))\ \delta^k + \varepsilon_{it}. \tag{1}$$

The treatment variable DP_i indicates whether an individual i has been displaced; it is a dummy variable, which equals 1 if the individual has been displaced due to a plant closure between 1990 and 1994. The value k represents the time since the plant closure. As I match treated and non-treated workers in the year prior to the treatment, for both treated workers and their (matched) counterfactuals, the dummy variable $PC_{it}(k)$ indicates whether the plant closure occurred k years ago; it equals 1 if individual i is observed in year t at a distance of k years from the plant closure. Note that, also for the non-treated counterfactuals, $PC_{it}(k)$ equals 1 if the plant closure happened k years ago (although only the treated workers actually experienced the plant closure). The outcome variable Y_{it} represents the number of months of calendar year t in which individual i does some training. Variations over the business cycle are captured by calendar year fixed effects θ_t. The ε_{it}'s denote the individual and time-specific residuals.

The parameters $\delta^0, \delta^1, \ldots, \delta^3$ capture the effect of interest. They are interpreted as the increase in the likelihood of investing in training in one more month per year when being displaced k years earlier; the counterfactual is the investment in training without the displacement k years earlier.

The identification assumption emerges with the difference-in-difference model formulated in (1). For each region and for each East German age group, the counterfactual of the displaced workers are the non-displaced workers. A necessary, although clearly not sufficient condition is the common trend of the pre-treatment outcome between the control and treatment group. Moreover, non-displaced workers cannot be interpreted as the counterfactual of the displaced

[11] Contrary to Jacobson et al. (1993), individual-fixed effects cannot be incorporated due to the small number of observations. However, I test the robustness of the results by including age and gender dummies; the results remain unchanged.

workers if there is some kind of selection into treatment or control group, e.g. through the industry of the worker, or through workers with lower ability being more likely to experience a plant closure. These and other threats to the identification assumption are discussed in Section 6.

4.2. Transition versus Stable Economy

In order to estimate the difference of the effects between the East and the West German subsample, the following difference-in-difference-in-difference (DDD) approach is applied to the pooled sample of East and West subsamples:[12]

$$Y_{it} = \theta_t + \sum_{k=-2}^{3} PC_{it}(k)\ \psi^k + \sum_{k=-3}^{3} (DP_i \times PC_{it}(k))\ \delta^k \tag{2}$$
$$+ \sum_{k=-3}^{3} (PC_{it}(k) \times East_i)\ \psi^{k,E} + \sum_{k=-3}^{3} (DP_i \times PC_{it}(k) \times East_i)\ \delta^{k,E} + \varepsilon_{it},$$

where $East_i$ is a dummy variable for being an East German.[13] For each period k since the plant closure, $\delta^{k,E}$ represents how the displacement effect on training differs between East and West Germans.

Comparing training activities of workers from the stable West German economy with training activities of workers from the transitioning East Germans economy underlies the following assumption: training opportunities were available and the supply of training opportunities was demand-induced, and not limited for either East or West Germans. This assumption particularly needs to hold for West Germans, for whom I find a smaller displacement effect on training participation. With the reunification in 1990, the West German institutional and legal settings were extended to East Germany. Part of this new institutional environment is the Bundesanstalt für Arbeit (the Federal Labor Office); it provides support for further training and continuing education. Whereas West Germany was already equipped with an established infrastructure of regional labor offices and training facilities, this infrastructure still had to be built in East Germany. Hence, it is rather East Germany which suffered from an under-supply of training opportunities. Due to this under-supply, any training effect of displacement in such transitioning economies could be underestimated. However, it is well known that the Federal Labor Office

[12] This DDD approach has been used by Ichino et al. (2017, equation (3)) to evaluate the difference in displacement effects of young and old Austrian workers.

[13] I also tested whether different business cycles in East and West Germany affect the results by including region-specific calendar-year effects. However, the results do not change.

focused on providing enough training opportunities in the East. For instance, in 1992, it spent 50% more on vocational training in East Germany, although its labor force was almost 75% smaller than the West Germans' (Hujer & Wellner, 2000). Besides, there is no evidence for a lack of training opportunities in the West. Therefore, the East-West difference in the supply of training opportunities is assumed to be demand-induced.

4.3. Before and after Re-entry into Employment

As soon as displaced workers find a new job, they have less time and higher opportunity costs for training activities. Neglecting their accumulation of new firm-specific human capital, their training activities may decline to the level of non-displaced workers. Moreover, with increased training activities during their post-displacement unemployment spell, they may have accumulated human capital which is more up-to-date than what they would have acquired without the displacement. As a consequence, the re-employed may invest even less time in training than without the displacement.

I provide some information on this employment-training trade-off by splitting the per-period effect on training δ^k, for each $k > 0$, by the employment status; the regression equation becomes

$$\begin{aligned} Y_{it} = \theta_t + \sum_{k=-2}^{3} PC_{it}(k)\ \psi^k + \sum_{k=-3}^{0} (DP_i \times PC_{it}(k))\ \delta^k \\ + \sum_{k=1}^{3} (DP_i \times PC_{it}(k)) \left(Empl_{it}\ \delta^{k,empl} + (1 - Empl_{it})\ \delta^{k,no\ empl} \right) + \varepsilon_{it}, \end{aligned}$$

where $Empl_{it}$ is a dummy variable for individual i's employment. It equals 1 if i is employed in most of the months of period t.

4.4. Young versus Old East Germans

Human capital theory suggests that young people have stronger incentives to invest in human capital. I test this prediction in the special scenario of the East German transition.

In order to compare the effects between two East German age groups, I split the East German sample by their age in 1990: People who are at most 40 are called young and form the base group. The remaining people are called old and are indicated by the dummy variable Old_i. For

the estimation, I use the regression model by Ichino et al. (2017, equation (3)):

$$Y_{it} = \theta_t + \sum_{k=-2}^{3} PC_{it}(k)\ \psi^k + \sum_{k=-3}^{3} (DP_i \times PC_{it}(k))\ \delta^k + \sum_{k=-3}^{3} (PC_{it}(k) \times Old_i)\ \psi^{k,Old} + \sum_{k=-3}^{3} (DP_i \times PC_{it}(k) \times Old_i)\ \delta^{k,Old} + \varepsilon_{it}.$$

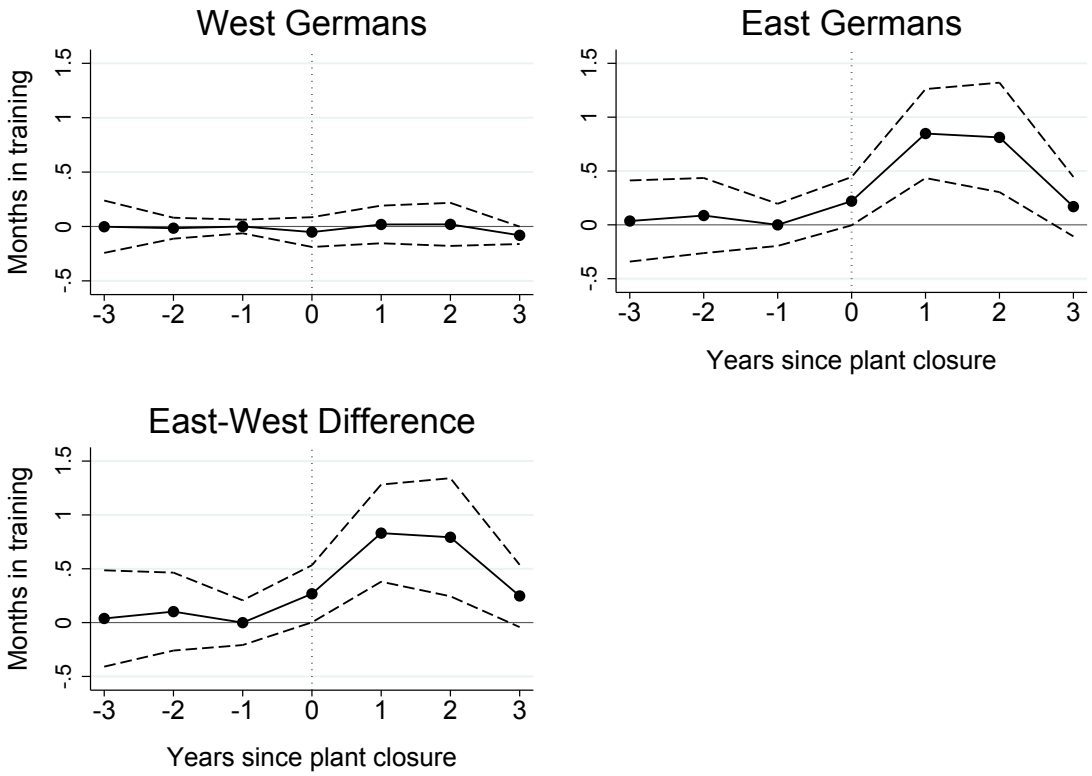
The parameter $\delta^{k,Old}$ captures the difference of the displacement effects between old and young East Germans for each period k after the plant closure.

5. Results

5.1. The Displacement Effect on Training Activities

Figure 2 displays the effect of job displacement in the rather stable West German economy, in the transitioning East German economy, and the East-West difference of the effects. For the exact numbers of the coefficients see Table A.1, Columns (1) - (3), of the Appendix. The upper panel of Figure 2 shows that, before the plant closure, displaced workers and the counterfactual non-displaced workers do not differ in the number of months in which they train. This holds for both East and West German workers. After the plant closure, displaced West German workers do not invest significantly more in training as they would without the displacement. If at all, in the third year after the displacement they spend marginally less time on training. In contrast, East Germans have an increased likelihood to invest in training activities after displacement. Particularly, in the first two years after displacement, the effect on training is stronger for East Germans (lower panel of Figure 2). With a probability of approximately 80% in both years, a displaced East German does some training in one more month than without displacement (right plot, upper panel of Figure 2). In the third year after displacement, the probability of additional training activities falls again to a level insignificantly different from that of the control group. The East-West-difference in the displacement effect can be interpreted in the following way: East Germans understand that they are living in a transition process. As soon as they lose their job, they notice that their skills have become obsolete and that they lack skills required in the market economy and for the modern technology; they have a strong incentive for continuing training in order to increase their chances on the labor market in the future. In East Germany, displaced workers immediately try to mitigate this human capital depreciation by exploiting

Figure 2: Displacement Effect on Training



Notes: Point estimates with 95% confidence intervals. GSOEP, own calculations.

the low opportunity costs of training during unemployment. In comparison, the West Germans' human capital did not depreciate that much; in general, only the firm-specific knowledge became obsolete. In the 1990s, the West German economic situation was rather stable for decades. Hence, West Germans had been trained in and for the same economic system as they are living in the 1990s. Incentives for adult training are, therefore, weak.

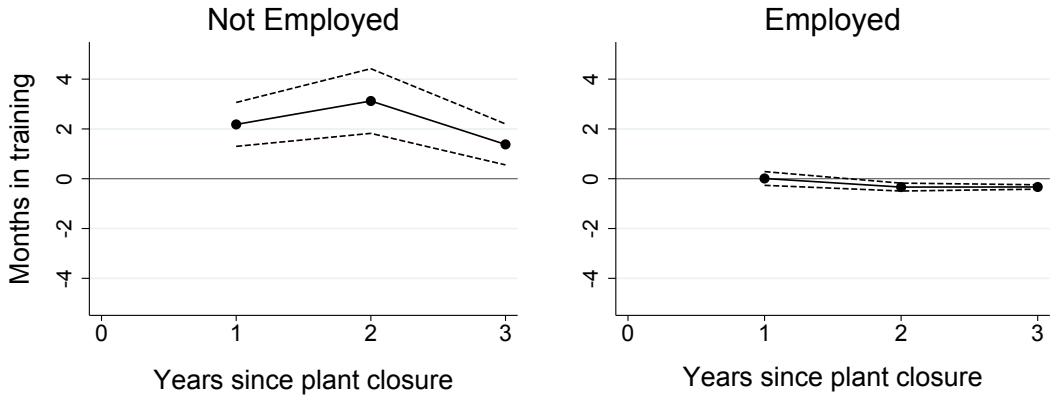
In the third year after the plant closure, displaced East German workers spend on average as much time in training as without the displacement (see Figure 2). For displaced West Germans, the effect is even marignally negative. One possible explanation for these lower training activities is re-employment. The re-employed workers may be fully occupied with their new jobs. As long as displaced workers are unemployed, their opportunity costs of training are low, but when they find a new job, opportunity costs rise again. The displaced East Germans may increased their training activities in the time of unemployment and, thereby, did planned training activities earlier than without the displacement. A negative displacement effect of re-employed East German workers would strengthen this argument. Therefore, in the next subsection, I study how the significant displacement effect on the East Germans' training activities is associated

with post-displacement employment.

5.2. The Effect on Training under Re-employment

Figure 3 shows how the effect of displacement on training is related to the employment status of the displaced East German worker:[14] If the displaced worker is not employed for at least 6 months in the first (second, third) year following the year of displacement, then, on average, that worker undergoes training in about 2 (3, 1) more months of that year - compared to what she would do without the displacement. For a displaced worker who is employed in more than 6 months per year the positive displacement effect on training vanishes. In particular in the first year after displacement, the number of months in which a displaced but employed worker does some training is indistinguishable from the months she would do some training in case of no displacement. In the second and third year after displacement, displaced workers who are mostly employed, invest even less in training than they would invest without the displacement: On average, in one month per year, displaced workers who are employed most of the year do less training compared to what they would have done without the displacement. This negative effect on training activities combined with the strong positive effect under non-employment suggests that East Germans make the highly necessary investment in training activities as soon as possible by bringing it forward to the time immediately after displacement - a time in which they are not employed and have low opportunity costs of training.

Figure 3: Displacement Effect on Training in East Germany, by Current Employment



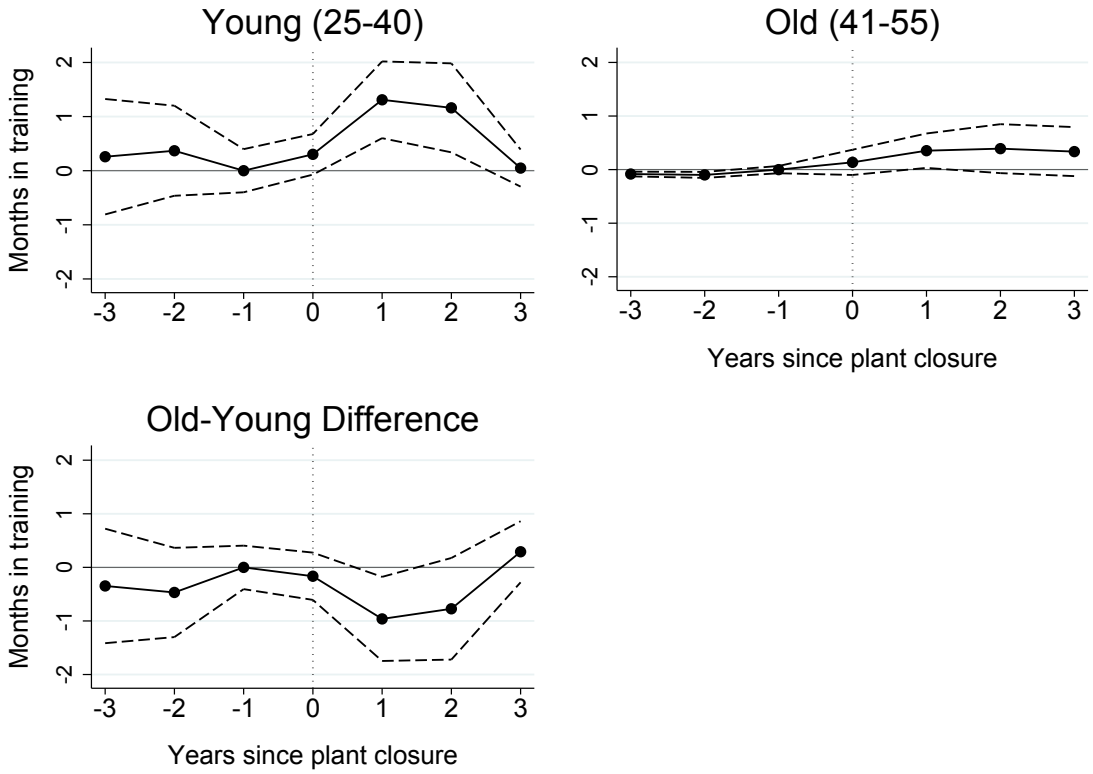
Notes: The header *Not Employed* refers to the estimate for people who are not employed in at least 6 months in $k = 1, 2, 3$ years after the plant closure; The estimate for those who are employed in more than 6 months are displayed under the header *Employed*. Point estimates with 95% confidence intervals. GSOEP, own calculations.

[14]The exact numbers of the coefficients are displayed in Table A.1, Column (4), in the Appendix.

5.3. The Effect on Training for Young and Old Workers

Figure 4 displays the effect of job displacement for young and old East Germans separately. First, it confirms the common trend assumption between the control and the treatment group for the subsample of young East Germans (see the upper left panel). The common trend assumption for the subsample of old East Germans is slightly violated as, contrary to the treatment group, the control group includes some old East Germans who did some training in the third and second year before the plant closure. I repeat the analysis with counterfactual workers matching the displaced workers additionally in the amount of training months two and three years before the plant closure. Thereby, the number of displaced workers matched falls from 228 to 226, the common trend assumption is fulfilled, and changes in the displacement effects are negligible; see Table A.2 in the Appendix.

Figure 4: Displacement Effect on Training in East Germany, by Age Group



Notes: Point estimates with 95% confidence intervals. GSOEP, own calculations.

Second, the upper panel of Figure 4 shows that both young and old East Germans invest more in training relative to their counterfactuals. For old workers, the displacement effect on training is only weakly significant in the first year after the displacement. On average, each young displaced worker increases her training activities one month more than older workers in the

first two years after the displacement (lower panel, Figure 4); however, only in the first year after displacement, this difference between the two age groups is weakly statistically significant. Later, for both young and old East Germans, displacement does not significantly affect the likelihood to alter time investments in training activities. The larger effect on training activities for young workers is in line with human capital theory: Young people can collect returns from human capital investments over a longer time horizon and, thus, their incentive for training is larger.

6. Limitations and Robustness

6.1. Limitations of the Data

As all survey data, the GSOEP provides self-reported information. Sometimes, this information is incomplete or implausible. Whenever possible, incomplete or implausible information has been replaced by imputed data; if imputation was not possible, such observations were dropped from the sample.[15] However, when I drop all individuals who have incomplete information on the matched variables within the time of the matching, the results in Section 5 still point in the same direction.[16]

One might argue that the GSOEP does not provide enough information on the history of East German workers as it only covers East Germany from 1990 onward and 1990 is already the first year in which the treatment, the plant closure, may occur. First, although pre-displacement information is scarce for the East Germans whose plant closed in 1990, these displaced East Germans are matched according to their sex, age in 1990 (older than 40, at most 40), education in 1990, and also to their employment and training activities in January 1990. This is possible as the earliest displacement observed in the GSOEP in 1990 took place in February 1990. Second, in the socialist GDR, equality was a major policy goal; unemployment was basically non-existent. Hence, additional information on the history of East German workers may have little added value.

[15] Imputation affects information on monthly employment and training activities as well as information on the place of living.

[16] Administrative data would be clearly preferable for the research question at hand; besides the absence of missing information, it would also cover more workers. To my knowledge, the only administrative data with all the information required is a combination of the IAB Employment Subsample (IABS) and the training participants data (FuU). It has been utilized, for instance by Bender, Bergemann, Fitzenberger, Lechner, Miquel, Speckesser & Wunsch (2005), to evaluate training programs. However, the relevant information on East Germans is not included before 1992. Excluding 1990 and 1991 in the analysis would mean to exclude the two most important years - the first two years of the transition, which show the highest displacement rates in East Germany.

Following the displacement literature, I identify involuntary job separations by focusing on the exogenous shock of plant closures. This shock is assumed to be independent of the workers' characteristics; however, the fact that a worker switches to a new job before the plant closure may not be exogenous. In line with the findings of Schwerdt (2011), one might expect that workers with higher skill levels are more likely to find a new job early. Such workers would be neglected in the treatment group, whereas workers with lower skill levels, who may have a larger need for further training, may be over-represented. As a consequence, the displacement effect estimated would be biased upwards for all the subsamples: West Germans, East Germans, young East Germans, and old East Germans. To explain the identified East-West difference in training activities, the skill level of displaced East Germans must fall well below the skill level of displaced West Germans; this, however, appears unlikely.

6.2. Further Limitations and Robustness Checks

There are certain questions that the baseline results may not have addressed. Is it conceivable that the estimated displacement effect stems from specific industries which were affected more often by plant closures and, thus, are over-represented in the treatment group? Could it be that the estimated East German displacement effect is driven by unproductive small firms where workers are less skilled and therefore require more training? Is East-West-German migration influencing the estimated displacement effect? May spill-over effects from the East German transition to the West German economy explain the insignificant effect on the West Germans' training activities? The next subsections focus on these questions.

Industry-specific Displacement

Plant closures may be more common in some industries than in others. In such cases, the displacement effect found may be due to specific industries which are over-represented among displaced workers and under-represented in the control group.

Unfortunately, the GSOEP does not provide direct information on the industry of the plant closed; but it provides information on the industry the worker is working in at the time of each interview. Therefore, I impute the industry of the plant closure using the month of the interview, the month of the displacement, and the industry mentioned at the last interview before the plant closure. As the GSOEP covers East Germans only since 1990 and some West Germans also entered the GSOEP in or after 1990, the last industry worked in is unknown for

some workers with a plant closure in 1990. For the control group, the month of the median displacement is considered as the displacement month. The month of the median displacement is computed for each year and regional subsample separately.

Table 2 shows that, given the information from the last interview before the plant closure, displaced and non-displaced workers do not match exactly regarding the industry branch. Among both the displaced East Germans and the displaced West Germans, manufacturing is much stronger represented as within the control groups. The opposite holds for the bank, insurance, and service industry. Moreover, compared to the control group, displaced East Germans used to work more often in agriculture or retail, and less in the transport industry.

Table 2: Industry Working for Prior to the Plant Closure^{+}

	East Germans		West Germans	
	Displaced	Non-displ.	Displaced	Non-displ.
Agriculture	0.12	0.07	0.00	0.01
Energy	0.03	0.02	0.00	0.01
Mining	0.04	0.02	0.00	0.01
Manufacturing	0.30	0.20	0.40	0.26
Construction	0.10	0.12	0.15	0.15
Retail	0.18	0.11	0.14	0.12
Transport	0.03	0.10	0.05	0.05
Bank, insurance	0.00	0.02	0.02	0.07
Services	0.17	0.30	0.19	0.27
Non-applicable	0.02	0.02	0.02	0.02
Unknown	0.02	0.01	0.03	0.03

Notes: $^{+}$Information from the last interview prior to the plant closure. For the control group of non-displaced workers, the numbers refer to the interview in the treatment year if the interview month lies before the median displacement month; otherwise, the answers of the previous survey year are evaluated. For 12 West Germans controls of the 1990 plant closures, a 1989 survey is not available and 10 East Germans who were displaced in 1990 were not interviewed before the displacement.
GSOEP, own calculations using cross-sectional weights adjusted by the number of treated workers and controls matched.

To rule out that the displacement effect found is due to specific industries which are under-represented in the control group, I conduct several robustness checks regarding the last industry observed prior to the plant closure. First, I add industry fixed effects using the last industry observed prior to the plant closure. If information on the industry is unknown, this is taken into account with an additional dummy variable. Moreover, I repeat the analysis without the workers with unknown information on the industry. This reduces the number of displaced workers to 210 East and 84 West Germans. In both cases, the main effects remain at a similar

level (compare, in the Appendix, Columns (2) and (3) with Column (1) in each of the Tables A.3 and A.4).

Second, I instead expand the matching procedure by the industry the workers worked in before the plant closure. In doing so, workers with missing industry information are matched with each other. I then end up with 210 (87) displaced East (West) German workers. Dropping workers with no information on the industry result in only 196 (82) people in the East (West) treatment group. In both the samples with and without the workers with unknown industry information, the main result does not change significantly (see Tables A.3 and A.4in the Appendix); there is no evidence that the estimated displacement effect in the baseline results is driven by the treatment group representing workers from different industries than the control group.

Firm Size-specific Displacement

The plant closure of a small firm may not be as independent of the workers characteristics as a plant closure of a big firm. If the firm is very small, the workers skills may be highly correlated with the likelihood of a plant closure. Hence, displaced workers from small firms may have lower unobserved skills than the non-displaced counterfactuals from small firms; these displaced workers may require more training and, therefore, may drive the estimated displacement effect. Like industry, the size of the firm with a plant closure is not explicitly given in the GSOEP. Therefore, I use the same procedure applied to the industry to infer the firm size.[17]

I check whether the results are driven by displaced workers in small firms by excluding all workers working in small firms before the plant closure. An additional robustness check uses only workers with a known firm size of 20 and more employees; the number of displaced East (West) German workers shrinks to 195 (69) and 181 (63), respectively. The results are robust to both changes in the sample (see Tables A.5 and A.6 in the Appendix).

Migration between East and West Germany

The fall of the Berlin Wall initiated a migration flow from East to West Germany. It peaked in 1990 and fell sharply until 1997 (Heiland, 2004). Until 1997, the outmigration amounted to about 10% of the GDR population from 1988; more than a third of them migrated before 1991.[18]

[17] In Section 6.2, it is described in detail how the industry branch is inferred with the information available in the GSOEP.

[18] Own calcuation, given information provided by Heiland (2004), (Grünheid, 2009) and the Statistical Yearbook of the GDR (Statistisches Jahrbuch der DDR, 1989).

One might argue that the East-West migration may influence the estimated displacement effect on training. First, I assume that the effect on training is associated with a person's previous human capital accumulation and, thus, with her stock of human capital and not with the place of living. Second, the institutional background is the same in both parts of Germany and, in both parts, training opportunities are available. However, one might still argue that displaced East Germans are less constrained and, therefore, are more likely to move to the West. There, they compete for a new job with West Germans whose stock of human capital is already aligned to the modern West German market economy; to increase their chances in the labor market, displaced East German migrants may increase their training activities. The displacement effect found would not stem from displacement per se, but from its impact on East-West migration. To test whether displacement initiates East Germans to move to the West, I estimate the baseline model with the outcome variable indicating that the individual is living in West Germany. Table 3 presents the coefficients of interest; none of them is significantly different from zero. In fact, only 3 of the 228 displaced East Germans moved to West Germany after the displacement. The sample size is too small to test whether East-West movers increase their training activities, but it strengthens the main results as it is unlikely that the East-West migration triggers the East Germans' displacement effect on training.

Table 3: The Effect of Displacement on Living in West Germany

	East Germans
DP X PC(0)	0.000
	(0.005)
DP X PC(1)	0.002
	(0.008)
DP X PC(2)	0.006
	(0.014)
DP X PC(3)	0.002
	(0.015)

Notes: Regression according to equation (1), where the outcome variable indicates that a worker is living in West Germany.
Robust standard errors in parentheses, * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

Spill-over Effects between the East German Transition and the West German Labor Market

As a result of the reunification, West Germany experienced a demand-induced boom in the early 1990s (see e.g. Müller, 1998) whereas the East German economy underwent an extensive transformation. Finding a new job may have been easier for displaced West Germans. If costs of displacement are lower, investments in additional training may have been less necessary. To check whether the estimated East-West difference in the displacement effect on training may stem from lower displacement costs for West Germans, I test whether employment costs of displacement differ between East and West Germans. I conduct a DDD estimation similar to equation (2), but using the number of months with employment as the outcome variable. Figure 5 shows that despite its higher magnitude for West Germans the displacement effect on employment differs only weakly from the effect estimated for East Germans in the second year after displacement (For the exact numbers, see Table A.7 in the Appendix.).[19] Therefore, I argue that the booming West German economy may have reduced the training activities of displaced West Germans but it appears unlikely that it is large enough to explain the whole East-West-German gap of the displacement effect on training.

Figure 5: East-West-Difference of the Displacement Effect on Employment

Notes: Point estimates with 95% confidence intervals. GSOEP, own calculations.

7. Summary and Conclusion

Following the German reunification in 1990, the East German economy underwent a transition from a command to a market economy. Many East Germans lost their jobs because of

[19] Moreover, considering quarterly data, the East-West difference on the costs of displacement in terms of employment are insignificant for all quarters.

plant closures while their human capital was not yet aligned to a modern market economy. Hence, displaced workers from East Germany lost all the three firm-specific, regime-specific, and technology-specific human capital. In contrast, displaced workers from West Germany lost, in general, only firm-specific human capital. In this paper, I study how displaced East German workers reacted to the stronger human capital depreciation. Using a difference-in-difference-in-difference set-up, I compare the effect of displacement on training activities between East and West German workers.

I find that East Germans increase their time investment in adult training significantly when they were displaced one or two years earlier. This increase in adult training is not observable for West Germans. Moreover, the displacement effect on training is more pronounced for young relative to old East Germans. These findings are in line with the human capital theory developed by Becker (1962, 1964), Mincer (1958, 1962), Ben-Porath (1967). Besides that, the results suggest that when East Germans lose their job due to a plant closure, they increase their training activities as soon as they are not employment anymore; but when they find a new employment, they invest significantly less time in training than they would have done without the job displacement. In that sense, plant closures may have a useful side-effect in a transition period because they allow people to counteract the human capital depreciation associated with the transition sooner.

Appendix

A. Regression Tables

Table A.1: The Effect of Displacement on Training of East and West Germans

	(1) West	(2) East	(3) All	(4) East
DP X PC(-3)	−0.002	0.036	−0.002	0.035
	(0.123)	(0.192)	(0.123)	(0.192)
DP X PC(-2)	−0.016	0.086	−0.016	0.086
	(0.049)	(0.178)	(0.050)	(0.178)
DP X PC(-1)	−0.000	0.000	0.001	0.000
	(0.032)	(0.100)	(0.035)	(0.100)
DP X PC(0)	−0.051	0.220	−0.048	0.220
	(0.070)	(0.114)	(0.073)	(0.115)
DP X PC(1)	0.019	0.848***	0.017	
	(0.088)	(0.211)	(0.090)	
DP X PC(2)	0.019	0.812**	0.020	
	(0.101)	(0.259)	(0.104)	
DP X PC(3)	−0.081*	0.169	−0.081	
	(0.041)	(0.141)	(0.043)	
DP X PC(-3) X East			0.038	
			(0.228)	
DP X PC(-2) X East			0.102	
			(0.185)	
DP X PC(-1) X East			−0.001	
			(0.106)	
DP X PC(0) X East			0.268*	
			(0.135)	
DP X PC(1) X East			0.831***	
			(0.230)	
DP X PC(2) X East			0.793**	
			(0.280)	
DP X PC(3) X East			0.248	
			(0.148)	
DP X PC(1) X No Empl.				2.182***
				(0.450)
DP X PC(2) X No Empl.				3.121***
				(0.662)
DP X PC(3) X No Empl.				1.378**
				(0.420)
DP X PC(1) X Empl.				0.011
				(0.141)
DP X PC(2) X Empl.				−0.334***
				(0.080)
DP X PC(3) X Empl.				−0.331***
				(0.045)
Observations	47288	22497	69785	22497
R^2	0.006	0.042	0.052	0.154

Notes: Robust standard errors in parentheses, * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

Table A.2: The Effect of Displacement on Training of East Germans

	(1) Young	(2) Young Match	(3) Old	(4) Old Match	(5) East	(6) East Match
DP X PC(-3)	0.259	0.000	−0.082***	0.000	0.264	0.000
	(0.544)	(0.009)	(0.023)	(0.004)	(0.545)	(0.006)
DP X PC(-2)	0.369	−0.000	−0.099***	−0.000	0.369	−0.000
	(0.424)	(0.579)	(0.028)	(0.003)	(0.424)	(0.585)
DP X PC(-1)	0.000	0.000	−0.000	−0.000	0.000	0.000
	(0.203)	(0.048)	(0.035)	(0.035)	(0.204)	(0.042)
DP X PC(0)	0.303	0.344*	0.136	0.134	0.302	0.342*
	(0.191)	(0.161)	(0.120)	(0.120)	(0.190)	(0.159)
DP X PC(1)	1.311***	1.351***	0.354*	0.349*	1.316***	1.357***
	(0.362)	(0.368)	(0.164)	(0.164)	(0.366)	(0.372)
DP X PC(2)	1.162**	1.203**	0.391	0.390	1.162**	1.203**
	(0.419)	(0.426)	(0.233)	(0.233)	(0.422)	(0.429)
DP X PC(3)	0.049	−0.205	0.337	0.338	0.049	−0.205
	(0.175)	(0.336)	(0.233)	(0.233)	(0.176)	(0.337)
DP X PC(-3) X Old					−0.346	0.000
					(0.545)	(0.009)
DP X PC(-2) X Old					−0.468	0.000
					(0.425)	(0.585)
DP X PC(-1) X Old					−0.000	−0.000
					(0.207)	(0.053)
DP X PC(0) X Old					−0.165	−0.208
					(0.225)	(0.200)
DP X PC(1) X Old					−0.961*	−1.008*
					(0.400)	(0.407)
DP X PC(2) X Old					−0.773	−0.816
					(0.484)	(0.489)
DP X PC(3) X Old					0.291	0.547
					(0.291)	(0.408)
Observations	13065	12462	9432	9144	22497	21606
R^2	0.062	0.074	0.027	0.028	0.064	0.074

Notes: The term *Match* denotes that the control and treatment group are additionally matched regarding the months of training in the third and second year before the plant closure.
Robust standard errors in parentheses, * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

Table A.3: The Effect of Displacement on Training, Robustness Checks: Industry (East)

	(1) Base	(2) Dummy	(3) Dummy	(4) Match	(5) Match
DP X PC(-3)	0.036	0.042	0.035	0.082	0.081
	(0.192)	(0.202)	(0.201)	(0.221)	(0.221)
DP X PC(-2)	0.086	0.097	0.096	0.184	0.187
	(0.178)	(0.187)	(0.187)	(0.191)	(0.194)
DP X PC(-1)	0.000	−0.022	−0.023	0.000	0.000
	(0.100)	(0.102)	(0.103)	(0.006)	(0.006)
DP X PC(0)	0.220	0.225	0.221	0.235*	0.259*
	(0.114)	(0.121)	(0.122)	(0.116)	(0.115)
DP X PC(1)	0.848***	0.852***	0.853***	0.694**	0.727***
	(0.211)	(0.223)	(0.223)	(0.218)	(0.219)
DP X PC(2)	0.812**	0.897**	0.900**	0.893**	0.920**
	(0.259)	(0.278)	(0.277)	(0.294)	(0.299)
DP X PC(3)	0.169	0.156	0.182	0.139	0.162
	(0.141)	(0.145)	(0.144)	(0.179)	(0.182)
Unknown Industry	*In*	*In*	*Out*	*In*	*Out*
Observations	22497	21903	21887	11994	11863
R^2	0.042	0.049	0.050	0.046	0.048

Notes: Column (1) with the header *Base* presents the estimates discussed in Section 5. The term *Dummy* denotes that the dummy variables is included for each potential industry the worker may have worked for before the plant closed. The term *Match* denotes that the control and treatment group are additionally matched regarding the industry the worker was working for before the plant closure. If workers with unknown industry categorization are included in (excluded from) the estimation, this is denoted as *In* (*Out*).
Robust standard errors in parentheses, * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

Table A.4: The Effect of Displacement on Training, Robustness Checks: Industry (All)

	(1) Base	(2) Dummy	(3) Dummy	(4) Match	(5) Match
DP X PC(-3)	−0.002	0.017	0.020	0.026	0.031
	(0.123)	(0.132)	(0.136)	(0.132)	(0.138)
DP X PC(-2)	−0.016	0.005	0.004	−0.056**	−0.057**
	(0.050)	(0.050)	(0.051)	(0.019)	(0.019)
DP X PC(-1)	0.001	0.020	0.021	0.000	0.000
	(0.035)	(0.032)	(0.033)	(0.005)	(0.005)
DP X PC(0)	−0.048	−0.087*	−0.069	−0.037*	−0.041*
	(0.073)	(0.043)	(0.041)	(0.016)	(0.017)
DP X PC(1)	0.017	0.046	0.046	−0.051**	−0.057**
	(0.090)	(0.095)	(0.096)	(0.019)	(0.019)
DP X PC(2)	0.020	0.047	0.041	0.043	0.046
	(0.104)	(0.115)	(0.118)	(0.111)	(0.120)
DP X PC(3)	−0.081	−0.064	−0.071	−0.078**	−0.080**
	(0.043)	(0.044)	(0.045)	(0.025)	(0.026)
DP X PC(-3) X East	0.038	0.026	0.017	0.056	0.050
	(0.228)	(0.242)	(0.243)	(0.258)	(0.261)
DP X PC(-2) X East	0.102	0.095	0.094	0.240	0.244
	(0.185)	(0.194)	(0.193)	(0.191)	(0.195)
DP X PC(-1) X East	−0.001	−0.041	−0.043	−0.000	−0.000
	(0.106)	(0.107)	(0.108)	(0.006)	(0.006)
DP X PC(0) X East	0.268*	0.311*	0.290*	0.271*	0.300**
	(0.135)	(0.128)	(0.128)	(0.116)	(0.115)
DP X PC(1) X East	0.831***	0.805***	0.808***	0.745***	0.784***
	(0.230)	(0.243)	(0.244)	(0.219)	(0.221)
DP X PC(2) X East	0.793**	0.848**	0.859**	0.848**	0.873**
	(0.280)	(0.300)	(0.302)	(0.315)	(0.322)
DP X PC(3) X East	0.248	0.216	0.251	0.215	0.241
	(0.148)	(0.152)	(0.151)	(0.181)	(0.184)
Unknown Industry	*In*	*In*	*Out*	*In*	*Out*
Observations	69785	67905	67215	32770	32545
R^2	0.052	0.060	0.061	0.060	0.061

Notes: Column (1) with the header *Base* presents the estimates discussed in Section 5. The term *Dummy* denotes that the dummy variables is included for each potential industry the worker may have worked for before the plant closed. The term *Match* denotes that the control and treatment group are additionally matched regarding the industry the worker was working for before the plant closure. If workers with unknown industry categorization are included in (excluded from) the estimation, this is denoted as *In* (*Out*).
Robust standard errors in parentheses, * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

Table A.5: The Effect of Displacement on Training, Robustness Checks: Firm Size (East)

	(1) Base	(2) Employers 20+ / unknown	(3) Employers 20+
DP X PC(-3)	0.036	−0.210***	−0.213***
	(0.192)	(0.042)	(0.043)
DP X PC(-2)	0.086	−0.128	−0.128
	(0.178)	(0.094)	(0.095)
DP X PC(-1)	0.000	−0.000	0.000
	(0.100)	(0.115)	(0.117)
DP X PC(0)	0.220	0.245	0.256
	(0.114)	(0.132)	(0.140)
DP X PC(1)	0.848***	0.941***	0.965***
	(0.211)	(0.244)	(0.256)
DP X PC(2)	0.812**	0.972**	1.054**
	(0.259)	(0.302)	(0.321)
DP X PC(3)	0.169	0.208	0.226
	(0.141)	(0.161)	(0.164)
Observations	22497	17188	16965
R^2	0.042	0.051	0.055

Notes: Column (1) with the header *Base* presents the estimates discussed in Section 5. The header *Employers 20+ / unknown* denotes that sample includes only workers who worked in a firm with at least 20 employers before the plant closure or for whom the firm size is unknown. The header *Employers 20+ / unknown* denotes that sample includes only workers who worked in a firm with at least 20 employers before the plant closure; workers without information on the firm size are excluded from the estimation.
Robust standard errors in parentheses, * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

Table A.6: The Effect of Displacement on Training, Robustness Checks: Firm Size (All)

	(1) Base	(2) Employers 20+ / unknown	(3) Employers 20+
DP X PC(-3)	−0.002	−0.009	−0.010
	(0.123)	(0.148)	(0.153)
DP X PC(-2)	−0.016	−0.023	−0.023
	(0.050)	(0.060)	(0.062)
DP X PC(-1)	0.001	0.001	0.001
	(0.035)	(0.042)	(0.045)
DP X PC(0)	−0.048	−0.054	−0.105
	(0.073)	(0.093)	(0.057)
DP X PC(1)	0.017	0.042	0.048
	(0.090)	(0.116)	(0.125)
DP X PC(2)	0.020	0.046	0.047
	(0.104)	(0.136)	(0.148)
DP X PC(3)	−0.081	−0.107**	−0.112**
	(0.043)	(0.039)	(0.041)
DP X PC(-3) X East	0.038	−0.201	−0.202
	(0.228)	(0.154)	(0.159)
DP X PC(-2) X East	0.102	−0.105	−0.105
	(0.185)	(0.111)	(0.113)
DP X PC(-1) X East	−0.001	−0.001	−0.001
	(0.106)	(0.123)	(0.126)
DP X PC(0) X East	0.268*	0.298	0.361*
	(0.135)	(0.161)	(0.151)
DP X PC(1) X East	0.831***	0.899***	0.918**
	(0.230)	(0.271)	(0.286)
DP X PC(2) X East	0.793**	0.925**	1.007**
	(0.280)	(0.331)	(0.354)
DP X PC(3) X East	0.248	0.313	0.337*
	(0.148)	(0.167)	(0.169)
Observations	69785	50512	47813
R^2	0.052	0.061	0.065

Notes: Column (1) with the header *Base* presents the estimates discussed in Section 5. The header *Employers 20+ / unknown* denotes that sample includes only workers who worked in a firm with at least 20 employers before the plant closure or for whom the firm size is unknown. The header *Employers 20+ / unknown* denotes that sample includes only workers who worked in a firm with at least 20 employers before the plant closure; workers without information on the firm size are excluded from the estimation.
Robust standard errors in parentheses, * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

Table A.7: The Effect of Displacement on Employment of East and West Germans

	(1) West	(2) East	(3) All
DP X PC(-3)	−0.051	−0.142	−0.051
	(0.347)	(0.328)	(0.346)
DP X PC(-2)	−0.016	−0.020	−0.015
	(0.266)	(0.133)	(0.269)
DP X PC(-1)	0.001	−0.000	0.002
	(0.150)	(0.113)	(0.150)
DP X PC(0)	−1.968***	−1.922***	−1.971***
	(0.419)	(0.262)	(0.427)
DP X PC(1)	−2.213**	−3.112***	−2.215**
	(0.735)	(0.409)	(0.749)
DP X PC(2)	−0.649	−1.929***	−0.644
	(0.473)	(0.419)	(0.476)
DP X PC(3)	−0.992	−1.011*	−0.993
	(0.520)	(0.417)	(0.518)
DP X PC(-3) X East			−0.091
			(0.477)
DP X PC(-2) X East			−0.005
			(0.300)
DP X PC(-1) X East			−0.002
			(0.187)
DP X PC(0) X East			0.050
			(0.503)
DP X PC(1) X East			−0.898
			(0.853)
DP X PC(2) X East			−1.281*
			(0.633)
DP X PC(3) X East			−0.021
			(0.666)
Observations	47288	22497	69785
R^2	0.100	0.147	0.143

Notes: Regression according to equation (1), where the outcome variable are the number of months with employment.
Robust standard errors in parentheses, * $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$.

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